

## SECTION IV.—RIVERS AND FLOODS.

## RIVERS AND FLOODS, AUGUST, 1915.

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[Dated: Weather Bureau, Sept. 30, 1915.]

*High summer stages in the Mississippi below Cairo.*—The annual spring rise in the lower Mississippi for 1915 fell short of a flood stage; the maximum stage on March 1 being about 1 foot less than flood stage at Vicksburg. From that date the river fell slowly, until May 27, reaching a minimum stage of 17.8 feet. A slow but steady rise then set in, cresting at 41.7 feet June 21, with a second crest stage of 41.4 feet on July 10 and a third, of 40.1 feet on September 7. The low water for the summer months was:

June..... 24.4 ft. on the 1st.  
July..... 38.0 ft. on the 31st.  
August..... 32.3 ft. on the 18th.

The last named is also the low stage between the dates June 5 and September 16, a period of 103 days during the summer season when much lower water is the rule. This is an extraordinary record and is not paralleled within the last 41 years. The nearest approach to it was during the summer of 1875. At that time, although the maximum stage was less than in 1915, yet, according to Section Director Barron, of the Vicksburg station, a greater volume of water was carried by the river at that time. There was then no continuous levee on the west bank of the river in the Vicksburg district, consequently thousands of acres of cotton when the plant was full grown and heavily fruited were submerged.

The flood of 1915, however, while not overflowing to exceed 1,000 acres of farm land, all of which was outside the levees, materially interrupted the construction work of the Mississippi River Commission.

The 1875 flood was due to a very considerable summer flood out of both the Ohio and the Missouri, while the high water of 1915 was due to heavy rains over the western tributaries and in the immediate watershed of the Mississippi between St. Paul and Cairo only. The final swell of 1915 came as a result of torrential rains in Arkansas and southeastern Missouri in connection with the West Indian hurricane of August 13–23. (See p. 411 of this REVIEW.)

*Floods in connection with the West India hurricane of August 13–23.*—The above named, in its course north-eastward from the Texas coast, was associated with heavy rains, particularly to the northwest and north of its center, the regions of heavy rains and dates being as follows:

17th. East Texas and northern Louisiana.

18th. East Texas, northern Louisiana and eastern Oklahoma, Arkansas, western Tennessee and Kentucky.

19th. East Texas, northern Louisiana, Arkansas, Tennessee, western Kentucky, and southern Missouri.

20th. Western Tennessee and Kentucky, southern Missouri, southern and central Illinois and Indiana.

21st. Lower Ohio Valley.

The total duration of the rains was 36 to 72 hours. In the beginning the rains were light to moderate; in the

last 36 hours, however, they were heavy but the latter characteristic was not noticed after the storm center passed beyond the Ohio Valley on the 22d.

The distribution of precipitation about the center of a tropical cyclone (or West India hurricane) is uniform, while the cyclone is in equatorial region; in this particular the tropical cyclone differs from the extra tropical. In the storm of the 13th–23d, the tropical characteristic as regards the distribution of precipitation about the center was seemingly maintained until the storm center reached the lower Ohio Valley, although there were sections in its path where the precipitation was both less intense and less uniformly distributed than at others. Thus in Arkansas the rains were quite heavy in the southwest portion of the State, considerably less intense in the storm's path through the middle portion of the state as it crossed the valley of the Arkansas River. The intensity of the precipitation was again renewed, however, in the northeastern portion of the State and the adjoining portion of Missouri. This fact has an important bearing on the floods in Arkansas rivers, as will appear later in this report.

*Texas rivers.*—Only the rivers of extreme east Texas were affected, and these only to a rather slight extent, as may be seen from the details in the table below:

TABLE 1.—Flood stages in rivers of Texas, August, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Trinity.....	Dallas, Tex.....	Feet. 25.0	20	21	Feet 30.0	29
Do.....	Liberty, Tex.....	25.0	20	25	25.8	23, 24
Neches.....	Rockland, Tex.....	20.0	19	20	21.4	19
Do.....	Beaumont, Tex.....	7.0	18	31	14.0	23
Sabine.....	Logansport, La.....	25.0	19	25	30.8	23
Do.....	Merryville, La.....	20.0	.....	.....	19.9	24, 25
Do.....	Orange, Tex.....	4.0	17	31	6.1	28, 29
						23, 24

The Red River and its tributaries, responding to a rather uniform distribution of heavy rains on the three days—17th to 20th—showed stages that as a rule fell short of the flood stage or slightly exceeded it, as also shown in the table. The upper Ouachita, above Camden, Ark., rose to a stage that overflowed the lowlands in the vicinity of Arkadelphia, Ark., but the flood stage in the lower reaches of the stream was not reached.

TABLE 2.—Flood stages in Red River and tributaries, August, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
Red.....	Fulton, Ark.....	Feet. 28.0	22	29	Feet. 31.4	24
Do.....	Spring Bank, Ark.....	29.0	.....	.....	28.8	30, 31
Sulphur.....	Ringo Crossing, Tex.....	20.0	.....	.....	19.3	21
Do.....	Finley, Tex.....	24.0	24	29	26.5	24, 25
Ouachita.....	Arkadelphia, Ark.....	18.0	20	22	21.4	21
Do.....	Camden, Ark.....	39.0	.....	.....	36.0	25
Little.....	White Cliffs, Ark.....	28.0	21	23	32.0	21

The Arkansas between Fort Smith and Pine Bluff was slightly above flood stage, except at the last-named point. The White, an important tributary that enters the Arkansas on the left bank near the junction of the latter with the Mississippi, reached the highest known stages at points along the upper and middle stretches of the stream. At Calico Rock the previous record of 43.1 feet, on February 14, 1884, was exceeded by 8 feet; at other points the excess above previous high water was much less. These remarkable stages were caused by continued heavy rains over the upper watershed of the White, the total fall in the three days August 17-20 being 10 inches or more. As previously stated, the intensity of the precipitation in connection with the West India hurricane of August 13-23 was markedly different in portions of its path through Arkansas, diminishing from 10 inches in Polk and Howard Counties to less than 6 inches in Faulkner, Cleburne, Pulaski, Jefferson, Arkansas, White, Woodruff, and Monroe Counties, in the valley of the Arkansas River, in the central part of the State. It is possible that the increased precipitation in Arkansas was due to topographic features, since many of the heaviest falls were reported along the eastern edge of the Ozarks, which here rise 500 to 1,000 feet above the valleys in the eastern part of the State.

TABLE 3.—Flood stages in Arkansas River and tributaries, August, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
		Feet.			Feet.	
Arkansas.....	Dodge City, Kans.....	5.0	26	26	5.3	26
Do.....	Fort Smith, Ark.....	22.0	20	21	24.5	30
Do.....	Dardanelle, Ark.....	20.0	21	23	23.0	21
Do.....	Little Rock, Ark.....	23.0	22	24	23.8	22
Do.....	Pine Bluff, Ark.....	25.0	-----	-----	24.3	25
White.....	Calico Rock, Ark.....	18.0	20	24	51.0	21
Do.....	Batesville, Ark.....	18.0	20	25	37.8	21
Do.....	Newport, Ark.....	26.0	22	31	33.9	24
Do.....	Georgetown, Ark.....	22.0	24	31	26.2	27, 28
Do.....	Clarendon, Ark.....	30.0	31	31	31.6	31
Black.....	Black Rock, Ark.....	14.0	20	31	31.9	21
Fourche la Pave Creek.	Bigelow, Ark.....	23.0	22	27	28.2	24

*The Meramec of Missouri.*—This stream has its origin in the eastern foothills of the Ozarks, in the southwestern part of Missouri, and flows in a northeasterly course, discharging into the Mississippi about 20 miles south of St. Louis. The Weather Bureau does not maintain any station along its course. The following account of the flood was extracted from the Engineering News of September 21, 1915:

The rain of August 19-21, in the St. Louis district, caused disastrous floods in the Meramec River to the south and west of the city, the greatest damage probably occurring at Valley Park, about 20 miles to the southwest.

According to the best reports the river rose about 7 feet on the night of the 19th and about 17 feet additional on the 20th. It was practically stationary during Saturday, the 21st, and it was generally assumed that high water had been reached, but during the night of the 21st and the day of the 22d an additional rise of 19 feet occurred, making a total of 43 feet above low water. This submerged practically the whole town well above the ordinary second-story level, and a large part of the rise having come during the night, it appears that a majority of the people were marooned in their own houses. As far as can be

ascertained, however, no lives were lost, but the damage to property was enormous.

This stage of the Meramec was probably partly a result of the condition of the Mississippi River, into which the former discharges 20 miles below Valley Park. The Mississippi rose from a stage of 22 feet on Thursday to a stage of 30 feet on Sunday.

According to newspaper reports 20 persons were drowned in various parts of St. Louis County, due to the floods of the 20th to 22d. In East St. Louis much farm land was overflowed by the breaking of the Wood River levees on the 21st. A part of the new levee at East Alton also gave way, flooding the lowlands and endangering lives, but prompt action prevented great loss of life.

*The Erie flood.*—Probably the most destructive local flood of the month occurred on August 3, in connection with a series of thunderstorms in northwestern Pennsylvania. The rainfall at Erie, Pa., was 5.57 inches in about 15 hours, resulting in a serious overflow of Mill Creek and the loss of much property and 30 lives.

The details of high water in the Mississippi and its tributaries, in which a flood stage was reached, appear in the table below.

TABLE 4.—Flood stages in Mississippi River, August, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
		Feet.			Feet.	
Mississippi.....	Keokuk, Iowa.....	14.0	1	1	15.2	1
Do.....	Warsaw, Ill.....	17.0	3	3	17.7	2
Do.....	Quincy, Ill.....	14.0	1	8	15.9	4
Do.....	Hannibal, Mo.....	13.0	1	11	16.1	5
Do.....	Grafton, Ill.....	13.0	3	12	19.9	6, 7
Do.....	St. Louis, Mo.....	30.0	5	6	-----	-----
Do.....	Chester, Ill.....	30.0	21	23	30.6	21
Do.....	Cape Girardeau, Mo.....	30.0	23	25	30.7	24
Do.....	Arkansas City, Ark.....	42.0	5	10	-----	-----
			21	28	34.2	25
			30	31	42.5	31

TABLE 5.—Flood stages in Illinois, August, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
		Feet.			Feet.	
Illinois.....	La Salle, Ill.....	18.0	1	31	24.2	5
Do.....	Peoria, Ill.....	16.0	4	17	18.5	8
Do.....	Beardstown, Ill.....	12.0	1	31	14.8	30, 31

TABLE 6.—Flood stages in Missouri River and tributaries, August, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
		Feet.			Feet.	
Missouri.....	Kansas City, Mo.....	22.0	1	10	26.4	1
Do.....	Waverly, Mo.....	23.0	1	3	24.0	2
Do.....	Boonville, Mo.....	21.0	1	11	22.9	3
Do.....	Hermann, Mo.....	21.0	3	4	21.1	4
Smoky Hill.....	Abilene, Kans.....	22.5	-----	-----	22.2	5
Do.....	Lindsborg, Kans.....	20.0	15	15	20.0	15
Republican.....	Clay Center, Kans.....	18.0	4	6	18.7	6
Grand.....	Chillicothe, Mo.....	18.0	1	9	27.0	6
Gasconade.....	Arlington, Mo.....	12.0	20	22	26.4	22

*Floods in rivers of the South and East.*—The table below shows the essential facts in connection with high water in the streams named. The flood in the White River of Indiana was due to the precipitation that occurred in connection with the West Indian hurricane before mentioned; the remaining floods were mostly due to heavy local rains in the respective watersheds.

TABLE 7.—Flood stages in various rivers, August, 1915.

River.	Station.	Flood stage.	Above flood stage.		Crest.	
			From—	To—	Stage.	Date.
		<i>Feet.</i>			<i>Feet.</i>	
Chattahoochee.....	Eufaula, Ala.....	4.0	20	21	.....	.....
Wateree.....	Camden, S. C.....	24.0	23	24	4.5	20
Santee.....	Rimini, S. C.....	12.0	13	13	24.4	13
Do.....	Ferguson, S. C.....	12.0	24	25	12.5	24
Roanoke.....	Weldon, N. C.....	30.0	19	20	.....	.....
Staunton.....	Randolph, Va.....	21.0	25	26	13.1	26
White.....	Elliston, Ind.....	19.0	14	14	30.4	14
St. Joseph.....	Montpelier, Ohio.....	10.0	15	17	20.8	13
Conoquessing Creek.....	Hartford, Conn.....	16.0	22	25	21.3	24
			23	23	10.0	23
			4	4	10.2	4
			6	6	16.5	6

*Loss of life and property.*—Between 50 and 60 persons lost their lives during the month by reason of floods. Thirty of this number perished in the Erie, Pa., catastrophe, and 20 more were drowned in St. Louis County, Mo., by the overflow of the Meramec and Des Peres Rivers.

The property loss is uncertain at best. Systematic efforts to arrive at an approximate figure are made by officials in charge of river district centers. These show an approximate loss of about four millions, distributed as shown in the table below; while out-of-hand estimates, made by newspaper reporters, show additional losses aggregating about four millions, distributed as follows: Erie, Pa., \$3,000,000; St. Louis County and western Illinois, \$1,000,000; making an aggregate of about \$7,000,000 for the month.

Property loss by flood, August, 1915.

District.	Tangible property, bridges, etc.	Crops.		Movable property (live stock).	Suspension of business.	Saved by warnings.
		In hand.	Prospective.			
Little Rock, Ark.....	\$371,250	\$608,250	\$1,133,300	\$38,600	\$70,000	.....
Fort Smith, Ark.....	15,000	10,200	85,000	500	.....	\$5,500
Shreveport, La.....	75,000	30,000	375,000	3,000	150,000	\$350,000
Columbia, S. C.....	.....	.....	.....	.....	.....	8,200
Total.....	461,250	648,450	1,593,300	42,100	220,000	363,700

<sup>a</sup> Mostly live stock.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

## MEAN LAKE LEVELS DURING AUGUST, 1915.

By UNITED STATES LAKE SURVEY.

[Dated: Detroit, Mich., Sept. 4, 1915.]

The following data are reported in the Notice to Mariners of the above date:

Data.	Lakes.			
	Superior.	Michigan and Huron.	Erie.	Ontario.
Mean level during August, 1915:	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Above mean sea level at New York.....	602.41	580.11	572.34	245.43
Above or below—				
Mean stage of July, 1915.....	+0.12	+0.19	+0.26	+0.30
Mean stage of August, 1914.....	—0.34	—0.52	—0.22	—0.90
Average stage for August, last 10 years.....	—0.23	—0.87	—0.32	—1.21
Highest recorded August stage.....	—1.52	—3.40	—1.77	—2.83
Lowest recorded August stage.....	+0.81	+0.26	+0.96	+1.08
Probable change during September, 1915.....	+0.1	—0.2	—0.3	—0.4